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Water Heater Systems.

Automatic vs. Storage.

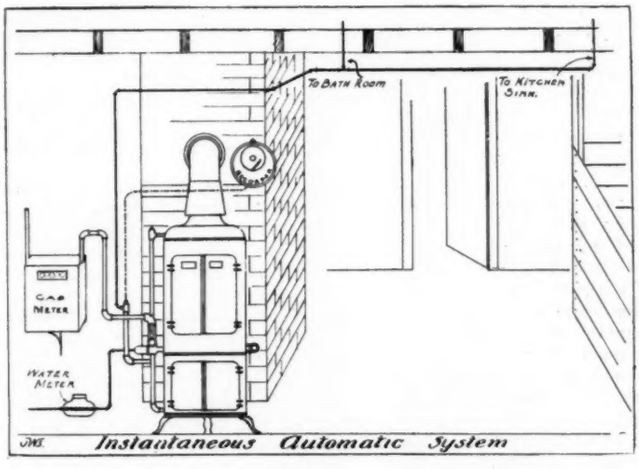
By E. S. STACK.

In order to obtain definite information regarding the hot water service rendered by the Instantaneous Automatic Water Heater, as compared with the Storage System, a study into the service which these heaters give was carried on at Newton, Mass., by the Newton and Watertown Gas Light Company.

METHOD OF TEST.

On March 14, 1916, a No. 4 Instantaneous Automatic Heater, installed in a private residence in Newton, was arranged to receive its gas through a separate meter, its water through a separate water meter, and to which outfit was applied a recording thermeter, as illustrated. The heater was one of modern make, and in first class working condition, connected properly in every particular, including the flue.

For several months previous to the installation of the special



Instantaneous Automatic System

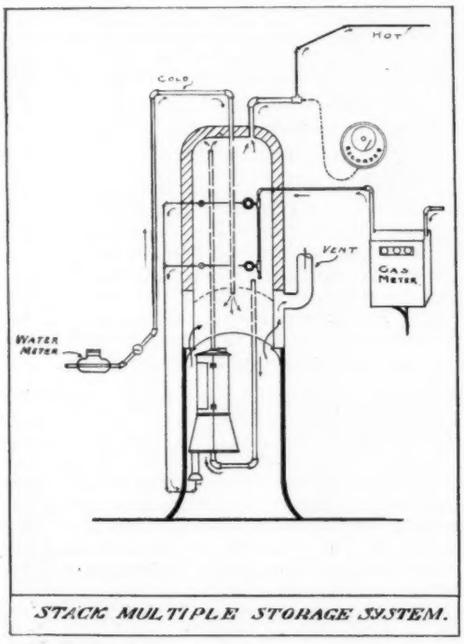
meters, this heater was furnishing hot water for the household at the rate of 2¼ gallons per minute, raising the temperature from 38° to 128°, at a cost of $6 to $7 a month. After setting the meters, there was no alteration made in the adjustment of the heater, as it was found to be giving the best service obtainable.

The tests showed that the quantity of hot water furnished through this heater was 120 gallons a day, at an average temperature of 108°. Besides the temperature given by the recording thermometer, the temperature of the water was taken as it flowed to the heater and also as it flowed from the hot water faucet.

The water, as far as the test was concerned, was drawn off at the kitchen sink which was supplied through a ¾" brass pipe 25 feet long, then reduced to ½" brass pipe having a run of 20 feet. On a test of 15 days duration the average quantity of water drawn per day through the hot water faucet was 120 gallons; gas consumed was 232 cubic feet per day. This furnished hot water service at a cost of $5.92 per month with gas at 85 cents.

The service which this heater was giving in hot water was 2¼ gallons per minute. This service was inefficient, and when the hot water faucet was opened at the kitchen sink no hot water could be had at the fixtures in the bathroom. It was also necessary to draw a considerable quantity of water from the hot water faucet before real hot water could be had.

In order to make a comparison between the Automatic heater



STACK MULTIPLE STORAGE SYSTEM.

and the Storage System in service rendered, a multiple storage unit of 20 gallons hot water capacity was used as illustrated. This heater simply displaced the Automatic heater and was connected to the water and gas piping in the same manner, also having a recording thermometer attached, and the temperature of the water taken in exactly the same manner as before.

As a basis of comparison the same rate of hot water per minute was used, and the flow of water from the Storage System was restricted to 2¼ gallons per minute. This heater was then operated under similar conditions to the Automatic for a period of 15 days.

The average quantity of water used in the storage system for the first 15 days was 79 gallons per day; gas 190 feet per day, or at a cost of $4.85 a month, as against 120 gallons per day for the automatic, at a cost of $5.92 per month.

It was quite noticeable that the temperature of the water from the storage system was much higher than that delivered by the automatic, and could be had much quicker on the opening of the faucet.

SUMMARY OF SERVICE TESTS.

Comparison of the Automatic and Storage Heaters.

Heaters operated and measured under exactly the same conditions and installed and used in actual service in a residence.

Hot water pipe between heater and faucet 25′ ¾″ brass pipe and 20′ of ½″ brass. A water meter, a recording thermometer and a recording gas meter were used. The temperature of the cold and hot water was taken by a hand thermometer each day. Water pressure 35 pounds, rate 6 gallons per minute.

After a run of 15 days on each heater the findings were as follows:

	No. 4. Automatic.	Multiple Storage System having 70 gallons Hot Water Storage Capacity.
Average daily quantity of hot water drawn	120 gallons.	79 gallons.
Average daily quantity of gas consumed	232 cubic feet.	190 cu. ft.
Rate per minute	4¾ cubic feet.	80 cu. ft. per hr.
Cost of gas per month at 85 cents	$6.30	$5.30
Initial temperature of water	38 degrees.	39 degrees.
Highest temperature of water	128 "	140 "
Average temperature of water	108 "	120 "
Rate per flow of water	2¼ gallons.	2¼ gallons.
Number times faucet opened daily	53	52
Average quantity of water per draught	2½ gallons.	1½ gallons.
Number of gallons for one cent	5¼ "	7 "
Efficiency based on test during day operation	60 per cent.	75 per cent.
Number of gallons necessary to get highest temperature	8 gallons.	2½ gallons.
Temperature of 3 gallons drawn	108 degrees.	120 degrees.
Quantity of water delivered	2¼ at kitchen sink only.	2¼ at each faucet.
With rate of flow 3 gallons per minute the maximum temperature was	118 degrees.	132 degrees.
With rate of flow of 4 gallons per minute the temperature was	102 "	132 "

Following is efficiency shown under actual working conditions including day and night service.

15 days service on Automatic showed an efficiency of 50%.

15 days service on Storage with flow of water checked to same capacity as automatic, the efficiency was 50%.

With storage outfit unchecked the efficiency reached 55%, calculated from temperature of water delivered at kitchen faucet.

With pipes covered from heaters to faucet, efficiency was increased 5%.

The above tests were made by the employees of the Newton & Watertown Gas Light Company, Newton, Mass.

Service Tests.

The idea in making these particular experiments was to get a line on just the kind of service each heater gave under varying conditions, and the storage system was set in operation under its normal condition; that is, the restriction of the water going through the heater was eliminated. In other words, it was installed just as it would be set up on the recommendation of the manufacturers

Several experiments were tried with the automatic heater which later were tried in exactly the same manner with tbe storage system. Following is the record of said experiments:

First.—Drawing water at hot water faucet every minute for one half hour, showed that for this form of service the automatic heater indicated an efficiency of 60%. The storage heater under this condition showed an efficiency of 74%. It was found that if hot water was drawn and then the faucet not opened for 10 or 15 minutes before the next drawing of the water, the efficiency of the heaters, especially of the automatic, was very much lowered.

This was due to the cooling of the water in the pipes, between the heater and the faucet, and also to the cooling of the water in the coils of the automatic heater.

Second.—The next experiment was to find out how long it would take to deliver water at the maximum temperature at the faucet. Starting with the water at its normal temperature in the coils of the automatic heater, and opening the hot-water faucet—it was noted that the temperature of the water in these coils and in the pipe normally stood at 75 degrees—it was found when two gallons of water had been drawn the temperature of the water being delivered at the faucet was 100 degrees, two and a half gallons 110 degrees, three gallons 120 degrees, and when eight gallons had been drawn the temperature was 128 degrees, which was the maximum temperature.

In making this experiment, with the storage heater it was found that when two gallons and a half of water had been drawn, the water was at its maximum temperature, which was 140 degrees. This would go to show that in order to get hot water from the automatic, much more water had to be drawn before really hot water was at hand. Evidently this is due to the fact that the storage system has water heated to the maximum temperature stored ready to deliver on the instant, whereas, in the automatic heater, the water has a normal temperature of 75 degrees because of loss through radiation, and the water has to be gradually heated up as it is being drawn. This, perhaps, accounts for the showing as stated: that the automatic heater delivered 120 gallons of water per day at the faucet, whereas the storage gave satisfactory hot-water service furnishing 79 gallons of water per day.

Third.—The next experiment was to find the average temperature of three gallons of hot water drawn. From the automatic the average temperature was 108 degrees, and from the storage a temperature of 132 degrees.

It was found that the quantity of water furnished for a cent with the automatic heater on an average run of fifteen days was six gallons at an average temperature of 108 degrees. It was found that the amount of water given by the storage heater was $4\frac{9}{10}$ gallons of water for a cent at an average temperature of 120 degrees. It should be noted that the water delivered from the storage was hot, and only warm from the automatic. Drawing water at intervals of one quart per minute until 7½ gallons had been drawn, the automatic furnished 5⅓ gallons of water for a cent at a temperature of 128 degrees, and showed an efficiency of 60%. The storage heater under like conditions furnished 6⅛ gallons for a cent at a temperature of 132 degrees, and showed an efficiency of 74%. The automatic used 15½ feet of gas during the experiment, and the storage 13 feet of gas.

The average number of times the hot water faucet was opened with the automatic heater during the 15-day period, was 53 times per day; the average number of times on the storage was 52 times per day. This showed that the average quantity of water drawn each time the faucet was opened on the automatic, was 2¼ gallons. The average quantity of water drawn each time the faucet was opened on the storage was 1½ gallons.

The pressure of the water was 35 pounds per square inch, the rate of flow of cold water was 6 gallons per minute. The pilot in the automatic heater used 2 cubic feet of gas per hour, the main burners used gas at the rate of 4¾ cubic feet per minute. The main burner of the storage heater, when turned on full, used about 80 cubic feet per hour, but only 40 feet of gas was used when turned half on. This fact is mentioned because the construction of the heater is such that only half of the gas is turned on at one time, the remainder being turned on only when required, being automatically operated by the quantity of water drawn from the system.

Fourth.—The next experiment was made with the storage heater operating in its normal way. Under these conditions the flow of hot water was greatly increased, so that hot water could be had at more than one faucet at a time. When drawing water at the rate of 2¼ gallons at the kitchen sink, a like quantity could also be had in the bathroom on the floor above. This test showed that the storage heater working in its natural way furnished 1½ gallons of hot water at each opening of the faucet at 7 gallons for a cent. (Under this test the heater was furnishing hot water at a cost of $5.10 per month, showing an efficiency of 67.5%.)

In studying the conditions, it was noted that hot water in the piping between the heater and the faucet and the coils in the automatic heater, would cool down at the rate of 25° in 7½ minutes.

Following is a description of the multiple storage system: The gas heater is placed inside a casing, in the form of a skirt, which surrounds the lower portion of 20-gallon insulated boiler.

There are two thermostats used, and the operation is as follows:

Assuming that the system is full of cold water and the gas is started, being supplied at the rate of 80 feet per hour, hot water leaves the heater and passes up through the pipe to the top of the boiler. As it collects in the top of the boiler and gradually makes its way downward and comes in contact with the first thermostat, which closes off half the supply of gas to the burner; with the remaining 40 feet of gas burning, hot water continues to come down the boiler until it comes in contact with the second thermostat, where the remaining 40 feet of gas is shut off, leaving nothing but the pilot light burning. When a gallon or two of hot water is drawn, cold water takes its place, and as this cool water comes in contact with the second thermostat, it necessarily turns on only 40 feet of gas per hour, and heats the quantity of cold water which has entered the boiler and which replaced the hot water which has been withdrawn. If a larger amount of water is required, cold water following up the boiler as the hot water passes out, comes in contact with the first thermostat, turning on the second 40 feet of gas, making a maximum capacity of 80 feet per hour, which quickly reheats the water, thus giving a quick as well as efficient supply. In other words, the gas is divided up and turned on in proportion to the load which is put onto the heater—small amounts of water, small amounts of gas—if larger amounts more gas in proportion. This multiple control is where the heater gets its name.

Utilization of Gas Oil.

From paper by R. C. DOWNING, to the Illinois Gas Association.

Gas oil is the most complex of the raw materials involved in gas-making, and future progress in the development of carburetted water gas must be attended with the accumulation of more information concerning gas oils. Oil refiners are endeavoring to find methods to convert gas oil into more valuable products, and through the application of physical and chemical principles, especially of phase law and mass action, a better control of products in oil refining has been obtained. By the Burton process, crude petroleum can be practically entirely converted into lighter fractions such as motor fuel or gasoline. The recent researches of Rittman and Snelling have demonstrated that it is possible to convert the end products into light oils containing a large percentage of benzene and toluene by the application of higher pressures with the removal of the liquid phase. The success which has attended, and will attend, this progress in refining petroleum is the cause of the high cost of gas oil, and for the tendency of refiners to supply poorer grades of gas oil than previously. It is an impossibility for the gas fraternity to prevent this upward march in price. The only alternative open to the manufacturer of carburetted water gas is to practice more efficiency in the utilization of oil. Not only does it appear necessary that efficiency in the use of oil be more highly developed, but it also seems essential that more attention be directed to methods whereby other kinds of fuel oil may be utilized as enrichers. Our knowledge of the behavior of inferior oils which might serve as substitutes for better-grade petroleums is very scant. One object of this paper is to call attention to what can be done in investigating oils in order to establish a definite means of accurately evaluating them, and increasing the efficiency of their utilization as enriching mediums.

SOURCE OF GAS OIL.

What is gas oil? From the general use of the word, any oil used in carburetting may be so termed, but the manufacturer of water gas generally understands it to be a product obtained from the refining of crude petroleum, most of which will distill off between 400° and 700° F. It has been defined as the product of crude petroleum distilling over between the burning and the lubricating oils. The definition was sufficient in the days when kerosene and lamp oils were in great demand. The gas oil was a product in the straight fractional distillation of crude petroleum, after the gasoline, naphthas and lamp oils were removed. It consisted of a mixture of heavy hydrocarbons with an average boiling point of 600° to 650° F., and was practically free from gasoline and lamp oil on the one hand, and from heavy lubricating oils and asphalt on the other.

Crude oils to-day are not handled in the same way as when gas oil first found use as an enriching medium. The oil refiner is not limited to fractional distillation, which produces a maximum yield of heavy oils. If he desires the maximum amount of gasoline, the oil is subjected to cracking distillation, the heavy vapors kept in contact with heated surface long enough to be broken down or decomposed into lighter fractions. After a crude oil is distilled the various products are submitted to divers separations, such as acid

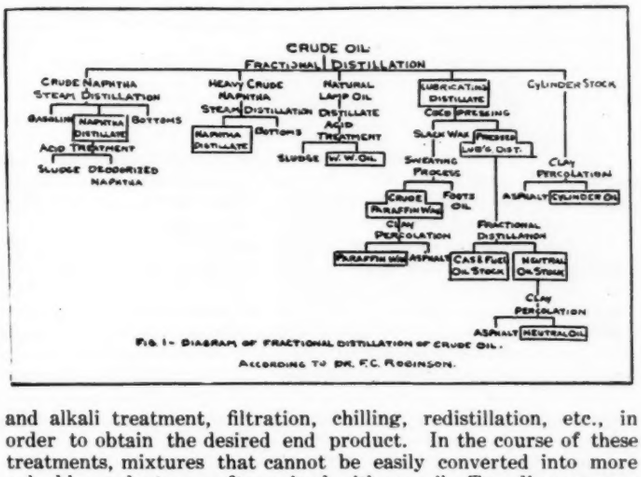


FIG. 1 - DIAGRAM OF FRACTIONAL DISTILLATION OF CRUDE OIL.
ACCORDING TO DR. F.C. ROBINSON.

and alkali treatment, filtration, chilling, redistillation, etc., in order to obtain the desired end product. In the course of these treatments, mixtures that cannot be easily converted into more valuable products are often mixed with gas oil. Two diagrams are appended which illustrate the general scheme in vogue in petroleum refining. From Fig. 1, it will be seen that gas oil stock is only

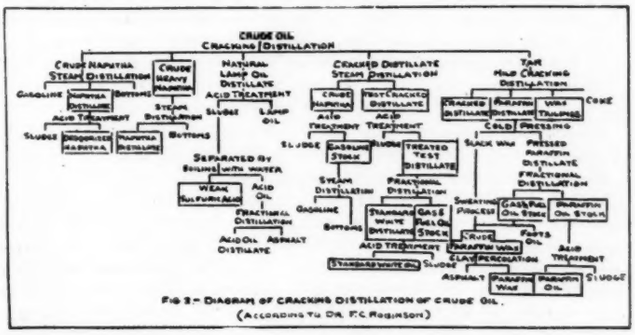


FIG 2 - DIAGRAM OF CRACKING DISTILLATION OF CRUDE OIL.
(ACCORDING TO DR. F.C. ROBINSON)

obtained at one point in the process. The scheme was used extensively in the early days of refining. At present more crude petroleum is refined according to the scheme of Fig. 2, where a

greater number of products are obtained and gas oil stock is produced at several points, the result being a more complex gas oil.

Composition of Gas Oil.

The great difficulty in evaluating a gas oil is due to its complex composition. The composition depends largely on the source from which it is derived.

The crude petroleum of this country can be classed under three headings:

(1) Paraffin Base Petroleum—A light colored oil found in Pennsylvania and West Virginia.
(2) Asphalt Base Petroleum—A black crude found in Texas, California and Mexico.
(3) Mixed Base Petroleum—A mixture of paraffin and asphalt base petroleum found from Ohio to Oklahoma.

In order to give an idea as to the chemical compounds present in petroleums, and which may be found in gas oil, the following table is inserted. Gas oils may contain:

A. Hydrocarbons.	General Formula.
1. Methane or Paraffin Series	$C_nH_{2n} + 2$
2. Ethylene or Olefine Series	C_nH_{2n}
3. Napthene Series (Hexahydro addition products of the Benzene Series.)	C_nH_{2n}
4. Acetylene Series	$C_nH_{2n} - 2$
5. Napthylene Series. (Tetrahydro addition products of the Benzene Series.)	$C_nH_{2n} - 2$
6. Series	$C_nH_{2n} - 4$
7. Terpene Series. (Aromatic dihydro addition products.)	$C_nH_{2n} - 4$
8. Benzene Series	$C_nH_{2n} - 6$
9. Stryolene Series	$C_nH_{2n} - 8$
10. Indene Series	$C_nH_{2n} - 10$
11. Naphthalene Series	$C_nH_{2n} - 12$
12. Acenaphthene Serics	$C_nH_{2n} - 14$
13. Fluorene Series	$C_nH_{2n} - 16$
14. Authracene Series	$C_nH_{2n} - 18$
B. Oxygenized Compounds.	
C. Sulphonated Compounds.	
D. Nitrogenated Compounds.	

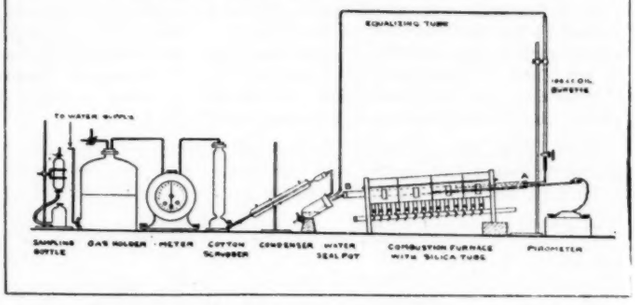
Gas oils consist largely of hydrocarbon compounds, Class A, with only small quantities of the other three groups. In a good gas oil the sulphur content is about 0.3% or less. In the asphaltic base oils, sulphur reaches at times over 1% by weight.

A determination of the principal component hydrocarbons of a gas oil is not easy, and is unnecessary for technical purposes. It is not sufficient to read the gravity of a oil on a hydrometer. Fractional distillation, while of value in determing mixtures of light and heavy oils, and of excessive residues, must likewise be supplemented by additional data. Chemical determinations of the nature of the oil, such as sulphonation and bromination tests, may be useful when sufficient data is available to render correct interpretation of the results. What we want to know is, how much gas can be made from a gallon of given oil when it is cracked at certain temperatures. We are concerned with the quantity produced and the quality of oil gas, and its stability when exposed to chilling. Such knowledge is beyond chemical analysis, but can be obtained by actual decomposition of the gas oil in the works machine. The application of cut and try methods, however, would be accompanied by great expense, and changing weather conditions would influence the results from day to day. The alternate procedure would be the installation of a model machine in the laboratory for investigation purposes.

Cracking Tests.

For some years it has been the practice in the Peoples Gas Light and Coke Company laboratory, to subject new or doubtful oils to cracking in an inclined silica tube. The tube, about 1" in diameter and 30" long, is heated in a furnace, the temperature of which can be controlled and measured. Oil is introduced from a measuring burette, at a constant rate; on contact with the heated walls it is decomposed, forming oil gas. The gas leaves the lower end of the tube through a seal pot, passing a condenser, scrubber and meter, to a small holder from which it is sampled and analyzed for illuminants, as shown in Fig. 3. Results are expressed as cubic feet of oil gas made per gallon of oil, also as cubic feet of illuminants obtained. Curves are plotted for each oil with temperature as ordinates and yields as abscissas. These curves show

Fig 3.
Diagram of Apparatus for Cracking Oils.



that gas from the decomposition of an oil increases with the temperature, but that its quality reaches a maximum usually at 1,300 to 1,400° F., and then decreases with increased temperature. By such a curve we can detect inferior oils and establish the most efficient temperature at which to operate with a given oil. Fig. 4

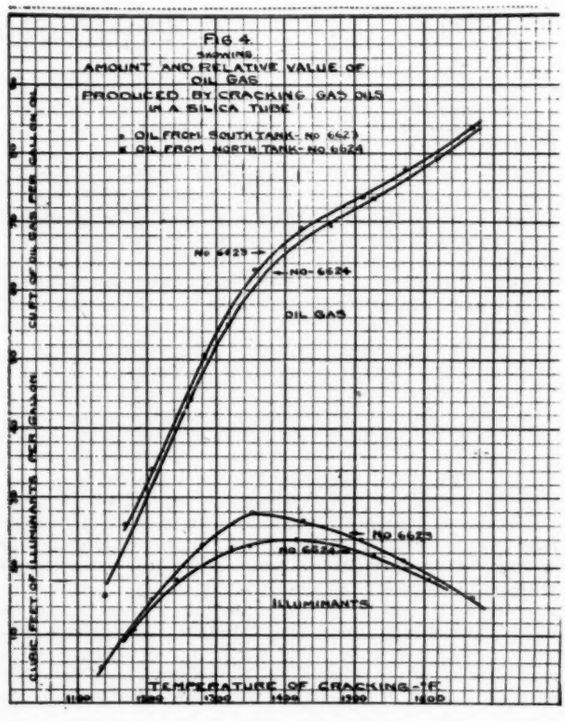


Fig 4.
Showing
Amount and Relative Value of
Oil Gas
Produced by Cracking Gas Oils
in a Silica Tube.
× Oil from South Tank - No 6623
× Oil from North Tank - No 6624
No 6623
No 6624
Oil Gas
Illuminants
Temperature of Cracking - °F
Cubic Feet of Oil Gas per Gallon of Oil
Cubic Feet of Illuminants per Gallon

shows two oils that gave decidedly different results in practice. At the working temperature of 1,350°, No. 6623 is seen to be about 16% more efficient than No. 6624. Results at the plant with these two oils showed a variation slightly greater than this, and the cracking test demonstrated that the difference was not due to operation, but to inferior oil.

By this method information can be had that will permit more intelligent interpretation of distillation results. For instance, with a given oil we may desire to know which distillation fraction is the most valuable,. It is easy to distil a large sample in the laboratory, and subject each one of the fractions to a cracking test.

Bromination.

While the cracking method gives important information concerning oils, it is desirable that other means, chemical or physical, simpler and more readily conducted, be found whereby a gas oil could be evaluated. Bromination appears to be of some use, but we were not able to draw any definite conclusions. A bromine number or absorption number is the number of grams of bromine absorbed by 100 grams of an oil. Bromine combines with paraffin and napthene oils in the sunlight; no action takes place in the dark or diffused daylight. Olefines or unsaturated hydrocarbons, on the other hand, are attacked by bromine, even in the dark. A gas oil

made by the cracking of the crude petroleum has high bromine numbers because of the olefines or benzenes. Further information on this method of testing can be found in the Proceedings of the A. G. I., Vol. 4, page 487. A. G. L. J., Mar. 28, 1910, page 582.

Acid Alkali Treatment.

Another method of ascertaining the nature of an oil is by sulphonation, or treatment with sulphuric acid. Paraffins and naphthalenes are not readily attacked by fuming sulphuric acid; the aromatic hydrocarbons, such as benzol, naphthalene, anthracene, etc., are attacked by the fuming, but not by the ordinary concentrated acid, when cold. Again, the latter acid acts upon the lower boiling numbers of the olefine series. This principle serves as a means of separation and evaluation. Tests show that by removing the attackable compounds a higher grade of oil is obtained, or, in other words, that naphthene and paraffins are the most valuable constituents in a gas oil.

Decomposition by Heat.

The remainder of this paper is an outline of experiments made to determine what actually takes place in a cracking zone similar to that of a gas machine proper. A gas oil under the influence of heat is first vaporized and then tends to decompose. If the time of exposure is long enough and the temperature right, the end products would be hydrogen and lamp-black. Investigations made by Tocher (Jor. Soc. Chemical Industry, 1894, vol. 13, page 231),with two members of the paraffin series, octane and decane, show that these are cracked by heat into similar liquids of the same series, accompanied by gaseous olefines, paraffins and hydrogen. At 930° F., ethylene and the higher olefines with methane and hydrogen were produced, while at 1630° F., ethylene, methane and hydrogen only—an indication of decomposition into simpler compounds. Octane, at a temperature of 1000° F., broke up into ethylene, propylene and butylene. Upon further heating to 1400 degrees F., the ethylene decomposed into carbon and free hydrogen, while the butylene broke down to ethylene. Thus it is seen that the higher the temperature, the greater is the tendency to form simpler compounds and deposit carbon. Bone and Coward have proven that an extended time of contact with the heated surface produces the same effect.

The action of heat alone is fairly well understood. All authorities have found that as the temperature increases the quantity of valuable gas from a given oil increases to a maximum, after which the gaseous hydrocarbons rapidly decrease and the deposited carbon increases. It has been shown in the experimental works of Whitaker and Rittman that the pressure and concentration of the decomposing products is also of vital importance. When an oil was cracked under diminished pressure the yield of gaseous hydrocarbons was greatly increased and the decomposition to carbon was practically eliminated. Less gaseous hydrogen was produced than at the same temperature under higher pressure. The same authorities have also corroborated the theory that there is a close relationship between the resulting gases in a cracking zone and the atmosphere in which the oil is cracked. They have demonstrated that admixed hydrogen inhibits the splitting up of the hydrocarbons, and accounts for the formation and preservation of the hydrocarbons after their formation in gas, with a corresponding decrease in the amount of tar and deposited carbon. Whitaker and Alexander have shown that a decrease in the time of contact produces gaseous products which correspond to gas formed at an earlier stage of the decomposition, or in other words, products similar to those obtained at a lower temperature and longer time of contact.

From the foregoing it is evident that the primary factors to be considered in any research of gas oil decomposition by heat are;

(1) The temperature of decomposition.
(2) The time of contact of the gas with the heating surface.
(3) The intimacy of contact with the heating surface.
(4) The pressure in the cracking zone.
(5) The concentration, or presence of foreign gases.

Plan of Research.

Carburetted water gas volume, composition and characteristics depend upon :

A: Blue gas volume and composition—depending on

1. Generator fuel composition.
2. Temperature of generator fuel surface.
3. Rate and time of blasting.
4. Time of contact of air and steam with hot fuel surface.
5. Amount of hot generator fuel surface.
6. Free space for steam or air.
7. Intimacy of contact of steam or air with hot generator fuel surface.
8. Rate of steam introduction.

B: Oil gas volume and composition—depending on

1. Blue gas volume and composition.
2. Temperature of hot brick surface.
3. Time of contact of oil vapors with hot brick surface.
4. Amount of hot brick surface exposed.
5. Free space for oil vapors and gas.
6. Intimacy of contact of oil vapors with hot brick surface.
7. Rate of oil introduction.
8. Gas oil composition.
9. Pressure of the gases in the machine.

These factors present a series of combinations and permutations for extensive investigation. It is evident that one or several of these combinations will produce maximum results, and the desire has been to definitely ascertain what this combination is. With the continual variation of conditions in a gas machine, it is impossible to ascertain with certainty the effect of any single factor. The only way to get the facts is to control all variables as much as possible, and then observe the effect of one fundamental separately. This was essentially the plan of research followed.

The production of blue gas has been studied by the U. S. Bureau of Mines, and it was not necessary to duplicate their work, although the apparatus used made it possible to do so. The nine variables relating to the gas volume and composition (B) have been partially investigated with the exception of pressure, and the influence of excess steam. Keeping in mind that candle power and B. T. U. are the elements under most careful supervision at a gas works, it was decided to obtain the candle power and heating value of the gas made under every conditon tried, and to express results in candles per gallon and gallons of oil per M. feet of gas made. With these results established, it is desirable also to know the stability of the gas, the amount of carbon deposited in the machine, the percentage of tar made, the specific gravity of the gas, and its analysis. All these have been considered in this research.

The First Machine Used.

An attempt was made to design an experimental device for cracking, essentially a model of the carburetter and superheater of the Lowe machine. It consisted of two 6″ pipes 30″ inches long, lined with fire clay, and provided with air and gas inlets so that the contents (¾″ clay marbles) could be blasted to any desirable temperperature. The temperature was read by pyrometer couples. Oil was introduced through a spray nozzle at the top of the carburetter, and blue gas to carry it in the machine was introduced at the same point. The decomposed products were conducted through a seal pot, scrubber, condenser, and metered into a holder. Gas made could then be subjected to candle power, and heating value tests, etc.

The difficulties in the operation of this machine were legion. After some experience it was possible to obtain a fairly uniform temperature by blasting, but because of the small size of the machine the temperature dropped very rapidly, and it was difficult to duplicate the heating conditions. Not more than two feet of gas were made during a run of five minutes, which was not enough for testing purposes. The machine leaked continually, due to the alternate heating and cooling. Then the fire clay lining proved an excellent absorbent for the oil, and as only 25 c. c. were used per run, this absorption could not be easily overcome. Blasting was so complete each time that the machine was left clean, ready to absorb oil on the next run. The best result it was possible to obtain with the machine was 4.7 candles per gallon, at a temperature of 1,375° F., and 5.25 gallons of oil per M. Under low temperature conditions, it was possible to obtain less than 25% methane, while at 1,400° F., the methane was 32%. This was doubtless due to the excessive heating surface in proportion to the voids, it being 17 times that which should have existed. By using 1½″ marbles the methane reduced to 21 and 25%, but the heating surface was still too large.

The Second Device.

A typical gas machine was used as a basis of this design, such as would furnish 17,500 cubic feet of gas per run of 5 minutes. The oil input was taken at 15 gallons. At a working temperature of 1400° F. about 65 feet of oil gas would be formed per gallon of oil, and about 11 gallons of tar per run. The gas made was assumed to be 30% oil gas and 70% blue gas, containing 15% excess steam. Free space of the machine was taken at 1,700 cubic

feet and heating surfaces of brick walls, arches, etc., at 11,350 square feet. With such a machine the time of contact of the oil vapors with heated surfaces was about 4 seconds. The ratio between the total square feet of heating surface and total cubic feet of space is about 7 to 1; between the surface of the brick and the free space brick work, about 12 to 1. In using the experimental device the limit upon the amount of gas made is the capacity of the meter. A common laboratory experimental meter will deliver about 15 cubic feet per hour accurately; a rate of oil input corresponding to this is about 2.5 c. c. per minute, or .066 of a gallon. This would mean that the experimental device must be about 22,600 times as small as a large gas machine. The proper ratio of heating surface to free space cannot be reached in a device of this size. It was decided, therefore, to keep the heating surface proportional to that existing in a gas machine, controlling the oil input and blue gas rate to give the desired time of contact. These conditions were obtained in a 2″ tube, about 42″ long, and this was used in the major part of the work following.

Construction of Machine.

To uniformly heat this pipe it was covered with fire clay about 1½″ thick. Provision was made for measuring the temperature by leaving two cylindrical openings in the fire clay ⅜ inches in diameter. The couples, introduced at each end, could be placed at any desired position along the pipe to give the temperature of the heating surface. In order to heat this pipe, either uniformly or irregularly, a special furnace was constructed (Fig. 11). The burner consisted of a ¾″ pipe 48″ long, drilled with two sets of holes. Any portion of these holes could be closed off by turning a piece of split brass pipe slipped over the burner proper. Eight of these brass cut-offs were supplied along the burner. Air for combustion was supplied by a small compressor and compressing tank. The combustion took place in the annular chamber around the cracking pipe and gave very uniform heat along its entire length. The cracking tube was inclined about 15°. The oil was introduced at the upper end of this tube, the rate of input controlled by a measuring burette. The blue gas was introduced at this same point, and by its velocity produced a spray effect with the oil, also serving as a blanket or carrier for the oil vapors. The gaseous products leave the lower end of the tube, and, after passing a tar pot, were cooled to room temperature by a condenser, scrubbed with beads and then with cotton, and metered with a 5-foot meter prover as a holder.

Blue Gas Manufacture.

Crushed coke, screened to pass a 10 mesh and be retained on a 40 mesh sieve, was placed in an iron pipe 30″ long and 1″ diameter set in the furnace at an angle of 30°. Each end was stoppered with a 1″ plug to permit of recharging while under heat and to remove ash and clinkers. Superheated steam was introduced through an orifice made by a No. 60 Morse Twist Drill and passed through the incandescent carbon, where it decomposed into hydrogen with the formation of carbon monoxide. This blue gas was taken off through a glass bottle, which served as a trap for undecomposed steam, and also indicated whether the decomposition was taking place properly. The presence of condensed steam was an indication of too low temperature or too rapid a rate of manufacture. A good gas was obtained when it left the heating zone almost dry. With this arrangement blue gas could be produced at the rate of 15 cubic feet per hour. The water gas was stored in an 80-foot holder for use as required.

Method of Operation.

The oil cracking furnace was brought to the desired temperature; this usually required about two hours. While the machine was heating up, blue gas was taken from the storage holder into the 6-foot holder. The apparatus for collecting the tar was cleaned, weighed and put in position. Gas from the street mains was then run through the system to remove all the air. A preliminary run was always made to purge the machine, condensers, scrubbers, meter and holder. After this purging the holder was emptied and both blue and finished gas meters set at zero. The run was then started and continued for about 20 minutes, or long enough to make from 5 to 6 cubic feet of gas. During this time the temperature was recorded at minute intervals at each of the four places along the tube, and not allowed to deviate more than 20° from the desired point at any time. The rate of oil input was also kept constant, likewise that of the blue gas. When sufficient finished gas was obtained, the run was stopped and readings made of the blue gas used, the gas made and the oil cousumed. From these figures the oil gas made in cubic feet per gallon of oil, its percentage of the total gas made, and the number of gallons of oil used per M. cu. ft. of gas, can be computed.

After allowing the gas to remain for about an hour in the holder to insure mixing, a sample was taken for analysis and B. T. U. and candle power determined. Street gas was burned in the calorimeter to have it working properly before the B. T. U. was taken. The analyses were made on the Morehead Burette with the following absorbents:

For Carbon Dioxide	Caustic Potash
For Illuminants	Bromine
For Oxygen	Pyrogallic Acid
For Carbon Monoxide	Acid Cuprous Chloride
For Hydrogen	Palladium
Methane & Ethane	By Combustion
Nitrogen	By Difference

Analyses were made on both blue and finished gases.

In order to determine the stability of the gas made, it was passed from one holder to the other, through a cooling coil of 40 feet of ¾″ copper pipe, immersed in water at 40° F. Sufficient time was allowed the gas in passing to secure the maximum candle power drop. When a sufficient volume of gas had been cooled the B. T. U. and Candle Power were again determined.

To determine the tar made, every piece of aparatus that served as a condenser, or collector, was detached and weighed. The difference in weight was due to the tar retained. With cotton in one of the scrubbers practically no tar escaped. A sample of the tar was taken, the apparatus cleaned with drip oil, dried and weighed, then used again in the next run. The gravity of the tar was taken and sulphur and carbon determinations made.

The following log sheet has been inserted as an example of data collected and methods of calculations used.

Data Sheet for Oil Gas Investigations.

Date * July 20th, 1915. Series A. Run No. 6.—Oil Mid-Continent.

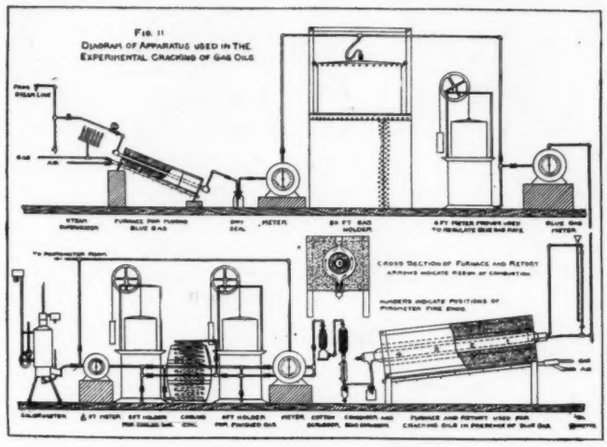
		Item No.
Average Temp. at Pyrometer No. 1	1305° F.	.....
" " " No. 2	1303° F.	.....
" " " No. 3	1308° F.	.....
" " " No. 4	1309° F.	.....
Average Temp. of Machine	1307° F.	1
Length of Cracking Zone	42″	2
Diameter of Carbureter	2″	3
Volume of Carbureter—Cu. Ft	.0763	4
Ratio of Sq. Ft. Heating Surface to Cu. Ft. of Free Space	24.1	5
Corresponding Spacing of Checkerbrick	1 3/16″	6
Rate of Oil Flow—c.c. per minute	2.5	7
Rate of Blue Gas in Cu. Ft. per min	0.1	8
Blue Gas Reading—Cu. Ft.	4.200	9
" " Temperature °F	80	10
Barometer	29.46	11
Correction Factor	.928	12
Corrected Blue Gas—Cu. Ft.	3.898	13
Finished Gas Reading—Cu. Ft.	5.809	14
" " Gas Temperature °F	80	15
Correction Factor	.928	16
Corrected Finished Gas	5.390	17
Color of Gas	Bright Yellow	18
No. of Minutes of Run	42	19
No. of Seconds of Run	2520	20
Oil used in Purging Machine—c.c.	15	21
Oil used during run—c.c.	105	22
Specific Gravity of Oil	.8614	23
Carbon Content of Oil—per cent	84.96	24
Sulphur Content of Oil	.263	25
B. T. U. per pound of Oil	18,680	26
Tar Made During Run—grms.	30	27
Specific Gravity of Tar	1.054	28
Carbon Content of Tar—per cent	83.8	29
Sulphur in Tar—per cent.	.807	30
	At 70° F. / At 40° F	
C. P. of Gas Made	26.82 / 24.09	31–31a
B. T. U. of Gas Made—Gross	706 / 696	32–32a
" " " —Net	654 / 644	33–33a
" of Blue Gas —Calc.	303 /	34

Analysis of	Finished Gas.	Blue Gas.	Item No.
Carbon Dioxide	2.8%	3.4%	35
Illuminants	14.0	.0	36
Oxygen	.6	.6	37
Carbon Monoxide	29.1	40.4	38
Hydrogen	28.4	50.6	39
Methane	21.2	.8	40
Ethane	.0	.0	41
Nitrogen	3.9	4.2	42
	100.0%	100.0%	
Specific Gravity	.67951	.5000	43
Hydrogen Sulphide	100	75	44
Pounds of Carbon	.14922	.054263	45

Calculated Results.

		Item No.	
Cu. Ft Oil Gas Made	$=5.390-3.898$	$=1.492$	I.17—I.13 = 46
% Oil Gas	$=1.492 \div 5.390 \times 100$	$=27.68$	$\frac{I.46 \times 100}{I.17}$ = 47
% Blue Gas	$=100-27.68$	$=72.32$	100—I.47 = 48
Cu. Ft. Oil Gas per Gal. Oil	$=(1.492 \times 3785) \div 105$	$=53.80$	$\frac{I.46 \times 3785}{I.22}$ = 49
Cu. Ft. Total Gas per Gal. Oil	$=(5.390 \times 3785) \div 105$	$=194.3$	$\frac{I.17 \times 3785}{I.22}$ = 50
Gal. Oil per M Ft. Gas	$=1000 \div 194.3$	$=5.15$	$1000 \div I.50$ = 51
Candles per Gal At 70°	$=26.82 \div 5.15$	$=5.21$	$I.31 \div I.51$ = 52
Candles per Gal At 40°	$=24.09 \div 5.15$	$=4.68$	$I.31a \div I.51$ = 53
Time of Contact in Seconds	$=\frac{2520 \times 0763 \times 520}{1307+460 \times 5.390}$	$=10.5$	$\frac{I.20 \times I.4 \times 520}{I.1+460 \times I.17}$ = 54
Wt. of Oil Used in Lbs.	$=(105 \times .8614) \div 453.6$	$=.1994$	$\frac{I.22 \times I.23}{453.6}$ = 55
Wt. of Blus Gas Used in Lbs.	$=3.898 \times .5000 \times .07658$	$=.1492$	$\frac{I.13 \times I.43a \times}{.07658}$ = 56
Wt of Raw Material Used	$=.1994+.1492$	$=.3486$	I.55+I.56 = 57
Wt of Finished Gas	$=5.390 \times .6795 \times .07658$	$=.2802$	$\frac{I.17 \times I.43 \times}{.07658}$ = 58
Wt. of Tar in lbs.	$=30 \times 105 \div 120 \times 453.6$	$=.0579$	$\frac{I.27 \times I.22}{}$ = 59
Wt. of finished products	$=.2802+.0579$	$=.3381$	$\frac{I.(21+22) \times 453.6}{I.58+I.59}$ = 60
Loss in machine as carbon	$=.3486-.3381$	$=.0105$	I.57—I.60 = 61
% of oil lost as carbon	$=.0105 \times 100 \div .1994$	$=5.26$	$\frac{I.61+100}{I.55}$ = 62
% of oil forming tar	$=.30 \div 120 \times .8614$	$=29.0$	$\frac{I.27}{}$ = 63
% of oil forming gas	$=100-(29.0+5.3)$	$=65.7$	$\frac{I.(21+22 \times I.33}{100-I.(62+63)}$ = 64
B.T.U. of oil gas per gal oil	$=\frac{(706-303) \times 72.32}{5.15}$	$=94,600$	$\frac{I.32-I.34 \times I.48}{I.51}$ = 65
Gal. tar per M. ft. gas	$=\frac{5.15 \times .3614 \times 29.0}{1.054 \times 100}$	$=1.22$	$\frac{I.51 \times I.23 \times I.64}{I.28 \times 100}$ = 66

These observations and calculations have been made on more than 150 runs under varying conditions of temperature, time of contact and intimacy of contact With the various types of oils investigated, the effect produced by different factors, such as temperature, time of contact, intimacy of contact, etc., show the same general tendency. The intensity of such change, however, has



varied. The oil most investigated was of the mid-continent type, having the following characteristics:

Mid-Continent Oil.

Specific gravity	8614 or 32.5° Be.
Initial Distilling point	160° F.
Flash Point	206° F.
Burning point	214° F.
B.T.U. per pound	18,680

Fractional Distillation.

Fractions.	Per Cent. by Weight	Sp. Gravity.	°Be.
0-300	Trace		
300-400	8.5	.8240	40.0
400-500	28.4	.8265	39.4
500-600	38.7	.8640	32.0
600-700	19.0	.9005	25.4
700 and above	2.3	heavy oil	
Loss	3.1		
Total and Aver.	100.00	.8641	32.5

Ultimate Analysis.

Carbon	87.24% by weight
Hydrogen	12.35% by weight
Sulphur	.26% by weight
Nitrogen	.15% by weight
	100.00

Bromination Numbers.

Total bromination	16.58
Substitution	5.12
Addition	5.66

The oil was cracked in the presence of blue gas of the following average compositions:

CO_2	4.0
O	.6
CO	40.4
H_2	50.6
CH_4	1.1
N_2	3.3
	100.0

H_2S=70 grains per 100 cubic feet.

(To be Continued.)

THE Census Bureau's summary concerning the cast iron pipe industry for 1914, includes reports from 69 establishments that manufactued cast iron pipe in 1914, the total products of which for the year were valued at $27,574,773. At the census of 1909 there were reported 59 establishments, with products valued at $29,153,723. The number of establishments in 1914 were greater by 9 then the number reported in 1909, but the total value of products increased by 9.6% during the 5-year period. Of the 62 establishments reported for 1914, 20 were located in Alabama, 10 in Pennsylvania, 9 in New Jersey, 7 in Ohio, 4 in New York, 3 in Michigan, 3 in Tennessee, 3 in Virginia, 2 in Illinois, 2 in Tennessee and 1 each in Colorado, Georgia, Maryland, Massachusetts, North Carolina and Oregon.

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Those who do Not Agree Please Rise.

This week the JOURNAL publishes three articles that should be read by every man interested in the commercial end of the gas business—this, of course, means everyone connected with the Industry.

The articles are; that on some comparative water heater tests, the one on business methods advocated for smaller towns, and the other on a free piping campaign.

Each of the authors makes statements not strictly in accord with general practice, or accepted standards, and as they have the merit of successful performance, they deserve your thought and attention.

Operators should give them consideration, and if they do not agree with the methods advocated, the columns of the JOURNAL are open for comment. In fact we solicit your criticisms, as by this means the industry will benefit.

Electric Cooking Campaign Organized.

A meeting of the representatives of electric range manufacturers and delegates from central stations, was held at the Congress Hotel, Chicago, Monday afternoon, May 22. At a previous meeting, held some three weeks ago in New York city, a committee was formed, composed of the following gentlemen, all of whom were present: J. F. Kileen, General Electric Company, Pittsfield, Mass.; H. P. G. Norstrand, Rathbone, Sard & Company, Albany, N. Y.; H. A. Louis, Hotpoint Electric Heating Company, Chicago, Ills.; R. B. Wooley, Standard Electric Stove Company, Toledo, O.; W. R. Putnam, Utah Power and Light Company, Salt Lake City, Utah; J. C. McLaughlin, Potomac Electric Power Company, Washington, D. C.; Hartwell Jalohick, Texas Power and Light Company, Dallas, Tex.; George Weiderman, Brooklyn, N. Y.; F. M. Feiker, *Electrical World*, New York; Charles W. Price, *Electrical Review and Western Electrician*, Chicago; C. A. Edkins, Commonwealth Edison Company, Chicago; J. D. Israel, Philadelphia Electrical Company, Philadelphia. Pa.; Frank Rae, Jr., *Electrical Merchandise*, New York; M. C. McMicken, Portland Railway and Light Company, Portland, Ore.; R. L. Lloyd, Philadelphia Electric Company, Philadelphia, Pa.

J. M. Wakeman, general manager of the Society for Electrical Development, was elected chairman of the meeting, and discussion followed at some length as to the best method of organizing an electric range educational campaign and co-operating with the central stations. It was finally agreed that the matter of advertising be left to the individual manufacturer, with the suggestion that a good deal of educational propaganda should be presented. It was further agreed that the Society for Electrical Development publish a booklet covering the electric range question in an independent way, presenting in full arguments in favor of the use of this modern utensil, the booklet to embrace the many good points of standard ranges. A committee to plan and carry out this matter was appointed, to consist of F. D. Pembleton, H. W. Alexander, F. E. Griffiths and Earl E, Whitehorne, the committee to have authority to add to its membership.

The Society for Electrical Development was also requested to prepare an issue in co-operation with the Commercial Section of the National Electric Light Association, a booklet to aid the central station salesman in selling ranges. The meeting was considered a very successful one in advancing the interests of this comparatively new and growingly popular product.

The St. Paul-Minneapolis Dispute.

In October, 1915, the Western States Coke Company contracted with the H. Koppers Company for a by-product coke plant to be erected in the vicinity of St. Paul, Minn. Differences arose with the St. Paul Gas Company in regard to the location of the plant, the Coke Company having decided to build it in Minneapolis, and

this resulted in a suit brought against the Coke Company by the Gas Company for breach of contract. This matter has now been amicably adjusted and the Western States Coke Company has assigned the contract to the H. Koppers Company, who will build the coke plant on a site near the shops of the Northern Pacific Railroad in St. Paul, and the plant, when completed. will be operated by a new corporation to be known as the Minneapolis By-Product Coke Company. Work will be started at once, and it is expected to have the ovens in operation early in the summer of 1917.

Gas Meeters, Philadelphia Section.

The Philadelphia Section of Gas Meeters held a most successful dinner at Bookbinder's, 125 Walnut street, Philadelphia, on Wednesday evening, May 24th. It was a Preparedness Meeting in several senses of the word.

Bookbinder's is famous for its shore dinners, and the Allies, consisting of the Commissioners and Mr. Bookbinder, demonstrated that they were prepared for a hungry and critical crowd. Forty-two members were present and they all enjoyed the steamed clams, broiled lobster, crabs, waffles and maple syrup, that were set before them.

Mr. Russell Duane, a member of the Executive Committee of the local branch of the National Security League, delivered an address on Preparedness, that for pure logical reasoning outranks any talks along this line that any of the Commissioners have heard. Mr. Robert ffrench Pierce described some of his experiences at the Plattsburg Training Camp.

Chairman Ralston notified the members that the election would be held at the next meeting, and urged them to prepare themselves for this important event, which will control the life of the local section during the coming year.

Three Hundred Cleveland "Gas Meeters."

The Cleveland Gas Meeters held a big banquet on May 20th, at the Hollenden Hotel, Cleveland, O., it being, no doubt, the biggest affair they have ever held, some 300 being present. The election of officers resulted os follows:

E. E. Wagner, Chairman.
P. Ostrye, Commissioner.
J. McCarthy, Commissioner.
Roy Cochran, Secretary-Treasurer.
Fred Gardner, Asst. Secretary-Treasurer.

The East Ohio Gas Company has given the Meeters the 3rd floor of a new storage building as permanent headquarters, and the new officers have launched a whirlwind campaign to secure 500 members, and have injected considerable interest into it by reducing the dues from $3 to $1 per year.

New York Section, I. E. S.

The June 8th meeting of the New York Section, Illuminating Engineering Society will consider street lighting, with special attention to the electric lighting of New York City. The meeting will be at the United Electric Light and Power Company's station, 187th street, near Broadway, and Mr. W. T. Dempsey will lead the discussion, showing moving pictures illustrating New York method of installation, construction and maintenance, and lantern slides demonstrating how the equipments have been standardized for the various types of streets.

At 8:45 there will be an auto inspection tour through Manhattan and the Bronx, to see interesting exhibits characteristic of the various types of installations, street lighting problems and demonstrations under actual operating conditions.

Dinner will be served at the Meeting Hall at 6 P.M. Price, $1. Those desiring to attend should advise Secretary N. D. MacDonald, 80th street and West End Avenue, New York City.

Massachusetts Gas Commission's Annual Report.

OPERATION OF GAS AND ELECTRIC COMPANIES DURING THE YEAR TO JUNE 30, 1915.

Included in the 31st annual report of Massachusetts Gas and Electric Commission for fiscal year ended June 30, 1915, we note the following:

Consolidated statement of 70 gas companies compares:

	1915	1914	1913
Income	$15,342,889	$15,051,135	$14,091,981
Expenses	11,069,125	11,291,059	10,112,265
Net profit	4,273,763	3,760,076	3,979,717
Sur aft divs., etc	154,851	*206,259	*6,121

*Deficit.

Summary of operations of incorporated companies and private-owned plants engaged in sale of electricity follows:

Income	$17,767,913	$16,771,413	$15,128,212
Expenses	10,734,054	10,025,352	8,995,055
Net profit	7,033,858	6,746,061	6,133,157
Sur aft divs., etc	197,307	266,013	29,698

Report of municipal plants, in three cities and 36 towns, of which four supply both gas and electricity and the others electric lighting, follows:

Electricity:	1915	1914	1913
Income	$1,131,948	$1,090,878	$1,052,498
Expenses	924,865	922,057	839,176
Net	207,082	168,820	213,321
Net def aft int, dep, etc,	31,546	58,020	2,710
Gas:			
Income	314,625	300,343	290,188
Expenses	250,582	233,945	212,244
Net	64,042	66,398	77,944
Sur aft dep., etc	65,315	61,617	71,009

Six of the 70 gas companies failed to earn expenses, compared with 5 last year, and total of companies not earning dividends was increased by 1 to 15 during the 12 months. Actual valuation of all the companies is $65,856,000, compared with $59,690,400 in 1914. Taxes of $1,321,467 were paid, an average of 7.7 cents per 1,000 feet of gas sold, an increase of .3 of a cent. The 52 gas companies paying dividends, distributed $3,960,002, an average rate of 8.9% on their capital stock, and which companies with dividends of $3,599,451 at rate of 6.6% in previous year.

Actual surplus of the gas companies, according to the June 30, 1915, balance sheet, was $8,077,836, or 17.79% on capital, compared with $7,614,011, or 18.9% in previous year and $7,891,268, or 20.63% in 1913.

Seven companies reduced the price of gas during the year. The average price paid by consumers for coal gas was $.851 per 1,000 feet, which compares with $.85 in each of two years previous and $.857 in 1912. Ten years ago the average was $1.05, and in 1886 it was $1.72.

Only one electric corporation failed to earn expenses, contrasted with 5 in 1914. Eleven did not earn sufficient to pay dividends, compared with 14 in 1914. The 43 dividend-paying companies distributed $4,004,108, which is a rate of 11.57% on capital stock, and compared with $3,503,404 and 10.22% respectively in 1914.

Actual surplus of the electric light corporations as of June 30, 1915, was $5,092,244, equivalent to 12.84% on capital, and compared with $4,675,791 and 13.51% respectively in 1914. In 1913 the surplus was equivalent to 12.22%. Aggregate assessed valuation of all the electric companies is $52,351,054, compared with $49,760,691 in 1914. This does not include the valuation of electric plants of the gas companies. Amount of taxes paid was $1,700,936, compared with $1,505,878 in 1914 and $1,422,557 in 1913.

Seventeen companies reduced price of electricity for commercial use, compared to 21 making reductions in 1914.

Selling Gas in a Town of 4,000 People.

How to Develop New Business.

CHAS. SMITH, Yankton, So. Dak.

In a small western town it is no easy thing to introduce gas where the necessity is not realized, especially as it is looked upon more as a luxury. Many retired farmers living in town own a wood lot on the farm, which, with corn cobs, furnishes the summer fuel. This, though, is gradually disappearing, as the retired farmers are turning the barn into a garage. In my town many of our patrons never saw gas burn before, so you have to make up your mind to be a missionary and get out and preach gas in season and out of season until they begin to take you seriously.

GET STARTED RIGHT.

One mistake made by most small gas companies starting in small towns is in being in too much of a hurry at the start. You must see that your manufacturing and distributing system is in perfect working order before you commence to operate. Stopping and tinkering with the plant after it is in operation destroys confidence to such an extent that the people look upon your service as unreliable. Give good service; keep up the quality of your gas; take time to see that each appliance sold is thoroughly understood by the consumer; in case of trouble have it attended to right away; select a good trouble man, one who is used to western ways and manners; meet the people on the plane on which they live; do not assume to know too much and make the consumer feel he knows nothing; let the axiom be "Get Consumers and Keep Them."

SHOW ROOM.

We have an up-town office and display room but we do not run our stove and appliance department in the interest of any particular stove manufacturer. We carry several first class lines in stock, so as to give variety, letting the person select the stove he fancies best. Our retail appliances consist of one, two and three burner hot plates, two and three burner mounted hot plates, two and three burner laundry stoves, then jumping to square ranges with full size burner tops. We have not handled the cheap lines of cookers for the last three years. If the party does not feel able to buy a range we recommend a mounted hot plate with portable oven.

We run services free, any reasonable distance to the meter. Also connect the stove and do the inside piping free, in the case of a new consumer, when the stove is bought from the gas office. And in case of second hand stoves or stoves bought elsewhere, we run the service free to meter and connect up stove at cost of labor and material.

There are no regular solicitors employed—we are all in the game. Aside from the office girl, we can all make gas, sell stoves, or keep books. It is simply a matter of what job needs doing the most.

THE SMALL CONSUMER YOUR BEST BOOSTER.

After all it is the laboring class that "cuts the mustard" in gas sales. Florida, in the winter, and lake districts in the summer are not for them. They stay at home and use gas, while the service pipe of the rich clogs and rusts. For that reason, study their needs. Sell them suitable goods. Show them how to get the most gas service for the least money. Be sociable with them. Learn their name as carefully as you would the name of Mrs. St. Bonds Clipper of Gold Rocks Manor. When they come into the office don't let them think that you are hedged in with a lot of formalities. Make them feel that you appreciate their business. They are good, honest folks, and for the most part they are worth knowing. Treat them right and they will get out and boost for you. They will get you a line of business you could not get otherwise, and it costs you nothing.

In a small town you have very little demand for industrial appliances. First start with the restaurant urn burner. Follow up with a gas stove for short order service; then a water heater. You then are in shape to talk all-gas cooking. Next comes the barber shops and small offices.

Hotel and restaurant cooking we have found difficult to hold, largely owing to the wastefulnese of the employees, although we have three hotel ranges, each using about 55,000 cubic feet per month. It was necessary to install these on trial in order to land the business.

Making over appliances that formerly used gasoline, such as peanut roasters, popcorn poppers, linotype machines and water heaters is done with the understanding that if the work is satisfactory the consumer is to pay for same.

TWO DOMESTIC SCIENCE CLASSES.

Our town is the home of Yankton Congregational College, and its Domestic Science Class is a source of revenue and a splendid advertisement. The new high-school building will be equipped for domestic science also. Homes can be reached through the children.

There is no official wall between the public and the gas company or between the men and the boss of that institution. We try to live and prosper as one family; hold the good will of the people; treat them so they will let us work for them as long as we need a job, remembering that we have to live with them next year as well as this and keeping ever before us the slogan of our good friend Thos. Crawford—DO GOOD, MAKE GOOD, BE GOOD.—*Abstract of Paper before the Iowa District Gas Association.*

N. C. G. A. Meeting, New York, June 8-9.

The mid-year conference program of the National Commercial Gas Association on Thursday and Friday, June 8th and 9th to be held at The Auditorium, Consolidated Gas Company Building, 128 East Fifteenth street, New York, is announced as follows:

FIRST SESSION.—GENERAL.

Thursday June 8, 2 P.M.

Opening of Conference—President Jansen Haines, DesMoines, Ia.

Address—Nathaniel T. Guernsey, New York.

Paper—"How the Gas Company and the Architect can Co-operate to the Best Advantage." D. K. Boyd, Philadelphia, Pa.

Discussion by prominent Architects and Members.

Domestic Science School Training, Its Effect on the Gas Business. T. M. Ambler, Brooklyn, N. Y.

Report of Committee on Reciprocal Relations with other Associations. C. R. Stull, Kingston, N. Y.

SECOND SESSION—INDUSTRIAL.

Friday, June 9, 10 A.M.

Paper—"Industrial Fuel Business." W. A. Ehlers, New York.

Topical Discussions.

"How to Survey your Territory Properly and Record and Follow up the Business." Thomson King, Baltimore, Md.

"Selection, Training and Compensation of Industrial Salesmen," G. M. Karshner, New York.

"How the Appliance Manufacturer can Assist in Securing Industrial Business." S. T. Willson, Brooklyn, N. Y.

"Standardizing Industrial and Engineering Data." G. W. McKee, Rockford, Ills.

THIRD SESSION—EDUCATIONAL.

Friday, June 9, 2 P.M.

Paper—"Education, the Basis of a permanent Industrial Preparedness" Dr. Lee Galloway, New York University, New York.

And Topical Discussions. For further details see our issue May 29, page 346.

Free Piping at Portland, Me.

BURTON SMART.

For a number of years we have realized that many of the better class of houses in Portland were being constructed with absolutely no provision for the use of gas, except for a range in the kitchen. The proposition was this: Were we to sit back with folded hands and let this lighting business get away from us forever, acknowledging that we were outclassed, or were we to try to retain what lighting business we had and get our share of the new business as well.

FREE SERVICE PIPE, 1915.

Although we realized it was to be an expensive campaign, we went into it a year ago, first by offering to lay free a gas service from the main to the cellar wall, to houses already built but not piped, if the run was not over ten feet from the building line; if the owners would pipe the first floor for range, water heater and lights such as we would recommend. Through that offer we secured the piping in whole or in part of some 50 houses, in 1915, otherwise unobtainable. (Our regular charge for service is $5.00 for single and $6.00 for a two family house, etc.) Taking ten of these as a basis, it cost us $88.86 for the services, $212.39 for the piping, $109.75 for the fixtures, or a total of $411.00. We charged for the piping $280.37 and for the fixtures $176.90, a total of $451.27. Profit $46.27, or $4.62 per house. This gave us 19 families and 144 new outlets, and each family using annually about 20,000 cu. ft. at 20c. per M. profit, would amount to $4.00 each, or $76.00 annually for the ten installations.

FREE SERVICE AND HOUSE PIPING, 1916.

But we still failed to secure much possible *new* business, so that on April 1st, 1916, we made a new offer to builders, as follows:

For any owner who would buy his fixtures and lamps of us, we would lay a ten foot service, and *pipe his house free.* This proposition was eagerly accepted by many, and we are of the opinion that by it we will obtain much business not otherwise to be had.

We give figures on ten concrete examples, representing a gross cost for services of $90.80; house piping, $199.44; fixtures, $367.33; total cost, $657.57. As against this cost we have received (billed) for same $525.40, making the net cost for this new business, $132.17, or $13.22 per new consumer. This figure does not include cost of advertising, accounting or some overhead expenses, but as an offset to this it does not include what profit is made on the range and water heater, which we nearly always sell on this proposition. These ten contracts gave us 9 families and 71 outlets.

As our average consumption per consumer (without street lights and gas sold other companies) is better than 20,000 cubic feet, this represents an annual consumption of 180,000 cubic feet, which at a profit of 20 cents per M. cubic feet, equals $36, which we figure we would have lost if we had not made such an offer. Does it pay? We will be in a better position to judge at the end of the year than now. These ten examples give us a return of $4 each on an investment of $13, or over 30% annually.

Following is our schedule of prices for lamps under this special offer, submitted for the consideration of the purchaser.

Lamps and Glassware.

Number of Rooms.	Inverted Lights and Glassware.	With Self-Lighters.
5	$10.20	$11.95
6	11.10	13.20
7	12.30	14.75
8	15.20	17.80

Terms: 5% 10 days, or 12 equal monthly installments.

We mark our figures up from 30 to 40% above cost.

Possibly we are somewhat better equipped to handle this work than some gas companies, for we have a thoroughly organized house-piping, fixture and lamp deparment, in which we employed 23 men in 1915, 18 in 1914 and 20 in 1913. The results for three years of our labor in these department have been as follows:

	Total H. P. Orders.	Houses Piped	Total New Outlets.	Fixtures.	Inc. Lamps.	Arcs.
1913	664	202	2,432	2,649	5,100	390
1914	912	428	2,417	2,554	6,297	604
1915	959	369	2,769	2,668	5,671	567
Totals	2,535	999	7,618	7,871	17,068	1,561

Without overhead charges for advertising, accounting department expenses, etc., the House Piping Department showed a profit of $2,269 in 1913, $1,160 in 1914, and $1,780 in 1915, or an average for the 3 years of $1,736, although, this year, with the free piping offer, we look for a loss.

For your further information as to some of the detail of our House Piping Department, will say that we use steel pipe almost entirely, which costs us about 40% less than wrought iron. We use black malleable iron fittings (not galvanized), and on pricing this pipe and fittings we mark it up 40% above actual cost.

As to labor, we charge 75c. per hour for fitter and helper, as they usually work together, 54 hours per week. We pay $2.50 to $3.00 per day for a fitter and $1.50 to $2.00 per day for the helper. All unaccounted for time is charged to House Piping Account.

We undertake to pipe new or old buildings, either concealed or exposed piping, as desired.

The average number of feet of pipe per outlet is 15 for new work, and the average run of pipe, per day, per crew, is slightly over 100 feet on new work. Seventy-five per cent. of our work is contract and the balance job work.

We use mercury pressure for testing—6" column to stand five minutes.

We consider it very important to have good workmen, to have the orders carefully taken by company representatives and all detail agreed upon with the party who is to pay for the work, having a careful working plan and specification made by our representative for our workmen's information, and signed approval of the owner. When we first started this department some 12 or 15 years ago, it caused a good deal of feeling on the part of the gas fitters in the city, but they drove us to it by putting in inferior piping, of undersize, usually, and poorly run. We believe our course in having this department has been justified many times.

Baltimore Centenary Plans.

A. W. HAWKS, JR.

Plans for the American Gas Centenary to be observed in Baltimore, Maryland, on June 16 and 17 are rapidly maturing, the major details of the preparations having been disposed of some time ago, as noted in the JOURNAL of May 22.

Prestige of a distinguished sort will be given the celebration by reason of the fact that Johns Hopkins University has assumed charge of one of the principal features. This is the meeting that will be held in McCoy Hall—the University's scholastic forum—the first night, to which prominent officials of the State and municipal governments, distinguished engineers, and men in the forefront of the gas industry, from all parts of the country will be invited.

Dr. Frank Johnson Goodnow, formerly adviser of the Chinese government, now president of the Johns Hopkins University, will preside, and in addition to making an address, will introduce the other speakers, all of whom will be men of national reputation.

The Consolidated Gas Electric Light and Power Company of Baltimore will be sponsor for the other events on the program. On the afternoon of June 16 it will give a great street parade in which several thousand men representing various departments of the company will take part. Eight bands will be in line and there will be four principal divisions.

There will be a long succession of floats, each of them being designed with the purpose either of displaying graphically the development of the gas industry or of demonstrating in practical fashion some particular present or past feature of dominant importance.

Legal.

GAS COMPANY NEGLIGENT.

The full bench of the Supreme Judicial Court, of Massachusetts, handed down a decision on May 18th, in a case of interest to gas companies and gas users generally. It involves the responsibility of the company that furnishes the gas over the inside piping condition, when any of their employees have been called inside the premises. It sustains the ruling of Judge White that the case on which the issues were framed was a proper one for a jury to pass upon, and that Judge White was right when he refused to take the case away from the panel.

The suit was that of Bertha T. Soulier of Fall River against the Fall River Gas Co. She had moved from one tenement to another, the latter a cottage house, and had asked the gas company to move the meter to the new home. The company's servants moved the meter and were unable to get gas through on account of the "drip." The drip is a sort of catch basin, in which the water constituents of the gas collect. The drip was in the yard and attached to the pipe connecting the house with the main. The house to which she moved was piped for gas and the lighting facilities were installed, including chandeliers.

The Taunton (Mass.) "Gazette" further states that when the plaintiff moved in she ordered, according to evidence that was agreed to as facts by both sides, from the gas company the moving of her meter to the new house, and on the following day, June 11, 1913, two men from the company came and itstalled the meter. They then tried to get gas through the chandelier in the kitchen. No gas came through and they told Mrs. Soulier that they thought that it was stopped up on the outside and would send for the "drip" man. A few days later another man from the company's office tried to light the gas, but there was none coming through the pipes, and on June 17 an employe named Laroche was sent to pump the water from the drip. Laroche did this and afterward, although, and the plaintiff's counsel admits it, the act was outside of his regular duties, he went into the kitchen at the request of Mrs. Soulier and assisted in the attachment of a mantle to the chandelier jet. After he did this there was evidence, which is not disputed, that Mrs. Soulier mentioned to Laroche that she smelled a strong odor of gas and that Laroche replied that it was coming from his clothes and that in pumping out the drip water he had spilled some on his hands, shoes and garments. He then went away.

Mrs. Soulier noticed the odor increasing, and on account of the smell of gas prepared to serve her dinner for herself and 3 children in the yard. She carried out some of the supplies and returned to the house to remove a pot of potatoes from the stove. She carried the pot to the pantry and was overcome by gas and was rendered unconscious, afterward being removed outside and revived.

It was then discovered that there was in the pantry an open pipe, left by a former tenant, who had unscrewed and taken away a gas range from the pantry. This open pipe was concealed by a piece of board, loosely put over it. It was admitted that this condition was unknown either to Mrs. Soulier or to any of the agents or officials of the gas company.

There was also evidence that for a long number of years Mrs. Soulier had been familiar with gas and its use, and knew of the dangers of escaping gas and was familiar with its odor.

The company claimed that its agents sent to make the connection and install the meter, and afterward to pump out the "drip," had specific service to perform, not connected with the pipes inside the house, which were not owned or controlled by it. They contended that with the knowledge of gas and its use, Mrs. Soulier was guilty of contributory negligence, to a degree that took away her right to sue, when she, after noticing increased gas odor, following the departure of the drip man, went again into the house; that she should, if ordinarily prudent, have known that the odor at that time could not be reasonably explained by the statement of Laroche, that it came from his clothes, and that she should have investigated and found an open cap on her own premises.

On these points, counsel for the gas company had asked a ruling that the jury be instructed to take the case from the panel. Judge White decided that the fact that an agent of the company, the drip man, had had his attention called to the odor, left it for the jury to decide whether he was negligent in not making a further examination in ascertaining its source. The jury verdict against the company stands.

Meriden, Conn., to Install Woodall-Duckham Verticals.

On May 22, the directors of the Meriden (Conn.) Gas Light Company met and authorized the erection of a continuous vertical coal gas plant, of the Woodall-Duckham type, of a total capacity of 750,000 cubic feet per 24 hours. The contract for the plant was awarded the Isabell-Porter Company, of Newark, N. J.

For some time the company has been considering the erection of a modern coal gas plant.

After a careful inspection of different types of plants, both abroad and in this country, by General Manager Charles A. Learned, the above type was chosen, it being considered that this equipment would best suit the particular needs of the company.

Their old retort house was built 43 years ago by James A. Hadley, the former superintendent. Its present equipment consists of eight benches of six horizontal retorts, 9 feet long with stop ends. The house is capable of making 400,000 cubic feet of gas per 24 hours. The output of the plant, however, ranges from 600,000 to 700,000 cubic feet per 24 hours, the difference being made up by water gas, which is manufactured in a modern plant.

The new plant will include a railroad siding, constructed of concrete, with a coal storage partly in the open and partly enclosed. Beneath the siding will be located a concrete coal hopper with crushing machinery and belt conveyor to take the coal into the retort house. A locomotive crane will be used on this siding to transfer coal from cars into storage, from storage into hopper when no cars are available; to handle coke into cars for transportation, to storage, and into the crushing plant. This crane will also transfer cars of coal and coke back and forth on the siding.

The retort house will be equipped with a carrier conveyor to elevate the coal to the overhead bunkers, which will have a capacity of 48 hours supply. The same conveyor will take the coke discharged from the retorts periodically to the night storage bin for coke, which will be located inside the retort house.

An elevator will be installed in the retort house for the convienence of the employees, and for ready accessibility to all parts of the house. A waste heat boiler of 75-horse power capacity will be connected to the main flue, this boiler being located inside the house; a chimney, 120 feet high, will also connect with the main flue. A 1,000,000 foot capacity primary condenser will be placed at the outlet of the hydraulic main, inside the building. From this condenser a 16″ line will connect with the exhausters in the present engine room.

A complete coke crushing and sorting plant will be installed, consisting of separate bins for breeze, nut, stove and lump coke; also a large bagging room for handling domestic coke.

The proposed location for the plant is ideal, it being 15 feet below the level of the New York, New Haven & Hartford Railroad. The lot on which the plant is to be built is 500 feet long and about 200 feet wide. Provisions will be made for large future extensions. The open coal storage can easily be made to hold 10,000 tons of coal, and the outside coke storage, 50,000 bushels of coke or more.

Gas Institute to Hold Four-Day Meeting.

At the sixth meeting of the present Board of Directors of the American Gas Institute held recently at the Institute Headquarters, the following were present; Wm. E. McKay, President; Geo. G. Ramsdell, D. D. Barnum, C. O. Bond, R. W. Bush, B. F. Cresson, G. B. Cortelyou, R. B. Harper, J. B. Klumpp, C. H. Nettleton, Herman Russell, J. D. von Maur, L. R. Dutton, Walton Forstall.

Upon motion it was voted to hold the annual meeting on the third Tuesday instead of the third Wednesday of October. This will increase the meeting time from a three-day to a four-day session.

Attention was called to Circulars No. 52, issued December, 1915, and No. 54, issued February, 1916, by the Bureau of Standards, on Electrolysis Mitigation, which was felt should be carefully considered by gas companies, copies of which could be secured by request from the Bureau of Standards, Washington, D. C.

Upon motion it was decided to accept the invitation to affiliate with the National Association of Railway Commissioners, and that the Chair appoint a committee of three to represent the Institute officially in this body.

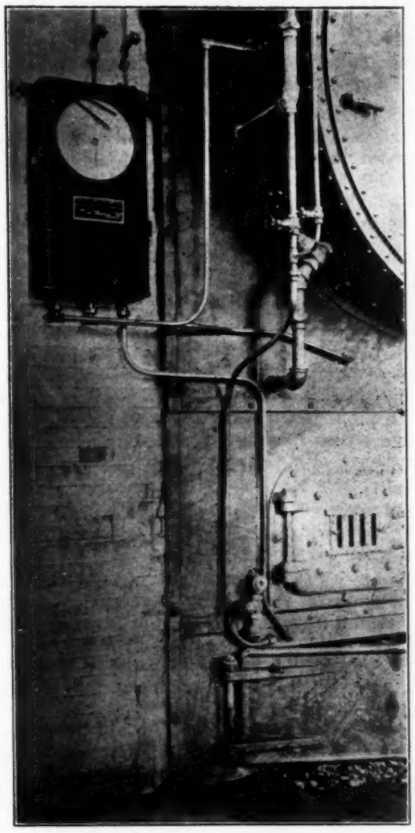
Messrs. Victor F. Dewey, Chairman; Carroll Miller, Walton Forstall, H. B. McLean and John Williamson were appointed as the Committee on Nomination of officers for the ensuing year.

New Methods and Appliances.

BAILEY BOILER METER.—The Bailey Boiler Meter is a combination of three separate meters in one casing, each drawing its own record in a distinctive color on a 12" chart; and records—

(1) The rate of steam output from the boiler.
(2) The rate of air flow through the furnace.
(3) The condition of the fuel bed.

It does much more than merely record them, for it correlates and compares these factors in such a simple manner that a fireman can readily understand the readings and be informed instantly of any needed change in the furnace or draft conditions to secure the best efficiency and maximum capacity.



Typical Meter Installation.

The steam flow is recorded by the red pen drawing a red record in the center section of the chart, the graduations being in per cent. of boiler's rated capacity on a uniform scale. It operates upon the principal of measuring the pressure difference across a Monel Metal orifice placed in a flange of the steam line.

The air flow is recorded by the blue pen drawing a blue record, arranged so that it travels immediately in front of and records just ahead of the steam flow. It is operated by the draft differential between the firebox and the uptake, but instead of reading in terms of draft it reads in terms of steam output. In other words it gives the same reading and draws a coincident record with the steam flow so long as the right amount of air is used for combustion. If the air flow reads more than the steam flow it shows too much air and corresponds to low CO_2; if it reads less than the steam flow it means insufficient air and loss due to unburned gases. This is based upon the principle that air is a fuel just as much as coal is, and a certain evaporation should be obtained per pound of air. This standard is obtained for each boiler and the meter adjusted accordingly.

The furnace indicator record on the outer section of the chart shows the conditions of the fuel bed. The fire is of the right thickness when this pen is on the shaded band, too thick when above and too thin when below the band. This also is adjusted to individual conditions after extensive tests have been made to determine the best kind of fire to carry. This furnace indicator is operated by draft pressures and is in reality a measure of the resistance of the fuel bed to the flow of air. It should not be confused with the drop in draft pressure across the fuel bed, for it includes the draft pressure in the uptake as well as the fire box and ash pit, in such a way as to eliminate the effect due to the intensity of the draft or the rate of flow of air and responds only to changes in condition of the fuel bed. That is, the pen does not move when the damper opening or draft pressure varies from maximum to minimum, unless the fire changes, but when the fire burns too thin or develops holes, the recorder shows it regardless of the intensity of the draft.

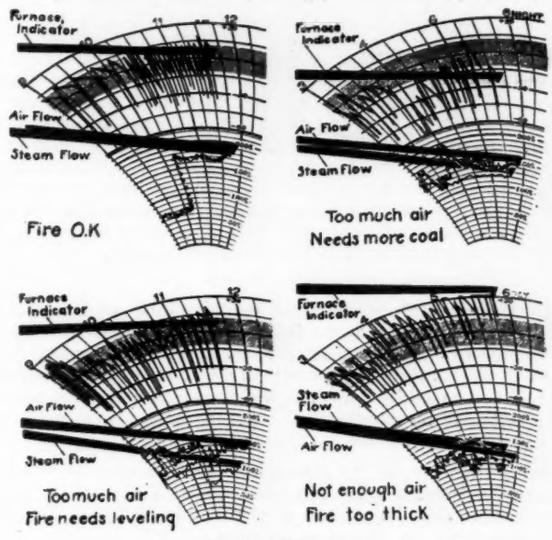


Chart Indications.

Every part of the meter responds instantly to changes in any of the operating conditions. In a hand fired furnace it plainly shows each opening of the fire door, cleaning of the fire, etc. When applied to stokers it brings out many very interesting points regarding the operation and control.

A NEW CONVERSION UNIT.—The "nu" is a new unit of measurement suggested by the "Practical Engineer" as a means of reconciling the English and metric systems. It harmonizes both systems, permits of subdivisions and calculation in its own decimal units and easy conversion to either system. The proposed standard of length is 5 ft. or 60 in. It is equal to 1.524 meters; to 152.4 centimeters. This conversion factor is divisible by 2, 3 and 4, and the length in inches, 60, is divisible by 2, 3, 4, 5 and 10. While the multipliers for conversion to metric measurements look irregular, they are exact in 3 places and are immeasurably simpler than conversion from yards or feet or inches to metric units. Going to larger measurements, the mile is 1056 nu. If a greater unit or gu. be taken, as 1000 nu., or 5000 ft., it will equal 1524 meters or 1,524 km., so that the same conversion multipliers will hold between the gu. and the kilometer as between the nu. and the meter.

SAVE YOUR WASTE PAPER.—The Bureau of Foreign and Domestic Commerce, Department of Commerce, has issued a pamphlet on the saving of waste paper material. The methods given include both a readymade and homemade baler. The advantages of having such an apparatus are given as follows:

1. Saving in storage space.
2. Decrease in fire risk.
3. Increased cleanliness and sanitation.
4. Easier to handle.
5. More readily salable.

Items of Interest from Various Localities.

As an indication of increased interest in gas lighting by combination companies, we note that:

Evansville, Ind., has sold 1,000 C.E-Z and 2,000 Radio-X lamps since January 1, and over 150 houses have been piped as a result of the special attention to domestic lighting. Mr. I. C. Shepard has been congratulated on the results.

At Jackson, Mich., the Michigan Light Company is pushing gas fully as vigorously for lighting as they do electricity, as is evidenced by the sale in May of 1,500 lamps. At Flint, Mich., the same company is also campaigning gas lamps.

Good result are also being obtained along the same lines at Dixon and Decatur. Ills.

At Newburyport, Mass., for the first time in its history, the Gas and Electric Company is selling gas appliances. Several hundred lamps and two carloads of ranges have been disposed of to date.

A BILL has been introduced in the New York Legislature requiring gas companies manufacturing or selling gas in New York city to meter all gas used by them in the conduct of their business and to make monthly reports to the Public Service Commission, showing the amount so consumed, together with the total amount manufactured and sold in the city each month. Gas so consumed by the companies, the bill provides, shall be charged to them at the rate charged regular customers, and, in ascertaining the cost of production and distribution shall not be reckoned as an item of expense or charged as an item of cost of production.

THE Brainerd (Minn.) Gas and Electric Co. is putting up a brick building 40 by 95 feet by 25 feet high on its gas plant site, and it is expected to have the plant going by August, according to J. C. Spiering, who is the gas superintendent. Offices have been rented and will be opened by June 1st, where a large display of gas stoves and ranges will be shown.

THE Hightstown, N. J., Borough Council has passed an ordinance granting permission to the Hightstown Gas Company to lay mains and erect a gas plant; and if the Public Utilities Commission passes favorably on the proposition work will be begun in three months.

THE Gulf Coast Gas Company, under its new organization, headed by William H. Armbrecht, of Mobile, has been granted a franchise in Gulfport (Miss.) the terms of which have not been made public.

THE Niagara Light, Heat & Power Company, Tonawanda, N. Y., has started the enlargement of its gas works on East Niagara street. The company intends to increase its coal gas supply about 20%.

THE only gas arc lamp on Fifth Avenue, New York City, N. Y., that has been in evidence for some time on that electric thoroughfare has been removed. The celebrated photographer, Marceau, believed in the superiority of Gas Lighting, but he has moved.

THE Holyoke, Mass., Municipal Gas Department is about to inaugurate a minimum monthly charge. Manager Kirkpatrick reports there are some 800 meters that show only from 5 cents to 30 cents per month consumption. representing an investment of $5.000, from which there is practically no income.

THE Jury of Award at the Third National Exposition of Safety and Sanitration, 1916, under the auspices of the American Museum of Safety, has decreed an award of the Grand Prize to the Consolidated Gas Company, of New York, for their exhibit of safety appliances, and for the general work of accident prevention to their employees and to the general public.

WHEELING, W. VA., has definitely shut down its municipal gas plant, and citizens of the section near the works are organizing a movement to have the plot used as a public park.

THE Springfield (Mass.) Gas Light Company has taken out a buiding permit for a $25,000 coke storage plant and trestle at its plant on Water street.

THE Peoples' Power Company has offered Rock Island, Ill., the following reduced rates, which, although not as low as the city officials hoped to get, will probably be accepted. They are:

For gas, pe meter per month—	Net
First 50,000 cubic feet	$.85
Next 50,000 cubic feet	.75
Next 50,000 cubic feet	.70
Next 100,000 cubic feet	.60
All in excess	.55

An additional charge of 10 cents per $1,000 cubic feet will be charged if the bill is not paid within 10 days from date of billing.

Minimum monthly bill 50 cents.

Electric Rates per meter per month—	Net	Gross
First 50 kilowatt hours	8c.	8½c.
Next 150 kilowatt hours	7c.	7½c.
Next 350 kilowatt houss	6c.	6½c.
Next 2,500 kilowatt hours	5c.	5½c.
All in excess	4c.	4½c.

Minimum monthly bill, $1.00.

The same rates apply to Moline, Ill.

THE Freeport Gas Association, composed of the employees of the Freeport (Ill.) Gas Company, met May 11th for their annual banquet. Owen Price, president of the association, presided. Two papers by members were read. The first, a humorous tale of the gas man's troubles, by Richard Haig, assistant superintendent; the other, by Arthur Grant, was a discussion of the work of the shop department. Mr. Grant took up several different phases in the relation between his department and the public, and showed how the shop could aid the consumer and the other departments of the company and thus increase the standard of service rendered.

THE Plymouth (Mass.) Gas Company announces that on July 1, the rate will drop from $1.70 per 1000 cubic feet to $1.65, with the same discount as now for prompt payment. The increased business of the company in the past few months has enabled it to lower the price in this manner to the consumers, and it is possible that as the list of customers expands with the use of gas as a fuel, still further reductions may be made.

THE by-product gas proposition of the Birmingham Railway, Light and Power Company will be accepted by the Birmingham, Ala., City Commission. The President of the Chamber of Commerce, who has been consulted frequently about the contract, has endorsed it warmly. He remarks: "It seems licenses to merchants, restaurants, bakers are being constantly increased. Now the city has the opportunity to give the people some reduction in the cost of doing business, and it should appeal strongly to the city commission and to the citizens of Birmingham."

THE State Railroad Commission of California, in its report on the valuation of the Modesto Gas Company, gives the company credit of being one of the best managed and up-to-date corporations in the State. The report says: "Mention should be made of the fact that above the average amount of care has been expended in the construction of the system, this being undoubtedly responsible for present service conditions. All machinery and buildings at the plant are kept well painted and in excellent repair. All underground piping in the distributing system is given a thorough coating of red lead and oil, and all necessary extensions have been made with wrapped pipe."

THE Fairfield (Ia.) Public Service Company is again asking that town for a franchise, this question to be decided by a popular vote on June 6. Another applicant has just turned-up, the Home Gas Light & Power Company, who also seek permission of the

voters to manufacture, or otherwise secure, gas and electricity for light, heat and power.

THE Central Foundry Company announces that owing to the increasing importance of its Western business, Mr. C. C. Todd, Vice-President of the Company will maintain an office in Chicago after July 1st, 1916.

IN the opinion of the Massachusetts Board of Gas and Electric Light Commissioners, general legislation covering the matter of outside shut-offs is not needed, they believing that it should be left to local authorities, as conditions vary in different places.

THE First District, New York Public Service Commission has ordered four gas companies in Queens Borough, New York City, to reduce their rates. The Newtown Gas Company is ordered to reduce its rate from $1 to 85 cents a 1,000 cubic feet, and the Woodhaven Gas Light Company, the Richmond Hill and Queens County Gas Light Company and the Jamaica Gas Light Company to reduce theirs from $1 to 95 cents. The orders were issued by the commission because the State Legislature failed to pass the bills suggested by it fixing the rates by law.

THE Annual Commencement Exercises of Stevens Institute of Technology, Hoboken, New Jersey, began on Saturday last with the Alumni Day exercises on Castle Point Field. At 2 P.M. there was the usual parade of Alumni, the classes competing for prizes for the most striking costumes. At 3:30 Stevens played against Columbia in a base ball game, and from 4.15 to 5.30 there was a lawn fete and band concert at Castle Stevens. The Commencement Day exercises will be on Tuesday, the 6th, beginning at 10:30 A.M. in the Auditorium.

F. D. BEATLEY, formerly of the Utah Gas and Coke Company, Salt Lake City, and latterly with Brooklyn Union Gas Company, has accepted the position of New Business Manager at Waterville, Me., with the Kennebec Gas and Fuel Company.

IN connection with Gas Range Week the Consumers' Gas Company, of Toronto, gave a series of lectures and demonstrations on cooking and kitchen management, at the Canadian Foresters' Hall, under the direction of Mrs. Esson Reid, late of the Department of Dietetics, Toronto General Hospital, Training School for Nurses. The lectures were on the afternoons of May 8, 9, 10, 11 and 12, and on the 13th there was a special lantern lecture on "Saving Gas in the Home."

THE Brockton (Mass.) Gas Light Eomployees' Association formally opened their new meeting rooms on May 21st, with an entertainment and social. Nearly 100 attended,including several of the employees from the out-of-town offices of the company. President John J. Sheehan acted as toastmaster, and the committee in charge was John J. Sheehan, John R. Pendergast, Richard J. Nagle, Roderick Donnell, Cornelius Reardon, Eugene LaRoque and E. B. Mooney.

TWO of the largest mortgages ever recorded in Warren County, N. J., are in two separate books which they require because of their length. One of the mortgages is given by the Pennsylvania Utilities Company to the Commercial Trust Company of Philadelphia, as trustee, to secure $5,000,000 in bonds. It carries revenue stamps to the amount of $1,500, and occupies 140 pages of printed matter. The other mortgage is made by the Pennsylvania Utilities Company to the Philadelphia Fidelity Company, as trustee, and is for $1,250,000, securing notes given for ten years. This mortgage has $625 worth of revenue stamps on it and requires 100 pages of printed matter. It covers the Columbia Water Power Company on the Pauline Kill at Columbia, Warren County, also the Phillipsburg Light and Power Company at Phillipsburg.

NEW YORK gas companies have operated during the enlightened B. T. U. era under candle power standard, graded according to the kind of gas made. More tests have been made in that State than probably all others combined. More conferences have been held, More hearing have been scheduled and still the old order remains. Arrangements were made some time ago to hold a combined hearing by both of the Public Service Commissions, and this has been adjourned to June 22, 2:30 P.M., at 120 Broadway, New York City.

JANSEN HAINES.

President of the National Commercial Gas Association.

MR. HAINES spent a couple of years in the West, after graduating from the University of Pennsylvaia, Mechanical Engineering Department, in 1893, and entered the service of the United Improvement Company on April 4, 1896, as a time-keeper at the Ardmore plant. He remained in their employ for a number of years in the capacity of assistant to the Superintendent of Works and as Inspection Engineer, and in 1903 he became Manager of the Des Moines Gas Company, succeeding Col. E. G. Pratt in that position; and on July 1, 1911, became President of the Des Moines (Ia.) company, the position he now holds.

MR. ELMER S. STACK, who contributes the leading article in this issue, has been identified with the plumbing business for the past 18 years. He is a Master Plumber and President of the Stack Heater Company, and has developed several water heaters of novel design, and a number of accessories. An article on "Tank Water Heaters," by Mr. Stack, appeared in our issue of April 10, 1916.

MR. H. A. WAGNER, President of the Consolidated Gas, Electric Light and Power Company, of Baltimore, Md., has been elected President of the National Electric Light Association.

MR. CAMERON BROWN, Campaign Manager of the General Gas Light Company, Kalamazoo, Mich., has been conducting a number of large campaigns for the New York office of the company, in addition to those handled in Kalamazoo. Some of the cities where he has handled Radio-X campaigns include Wilmington, Del., York, Pa., Lakewood and Belmar, N. J., and Newburyport, Mass.

MR. W. RE. BROWN, recently elected Editor of the Wrinkle Department of the Natural Gas Association, is Commercial Manager of the Ohio Fuel Supply Company, Columbus, O., and a brother of Cameron Brown.

MR. BURTON SMART, since 1900 Treasurer of the Portland (Me.) Gas Light Company, is a native of Portland and entered the gas business in the employ of that company in 1895. He is an active member of the leading Republican Club of Maine—the Portland club; the Portland Rotary Club, the Round Table, and the Chamber of Commerce; a director of the N. E. Association of Gas Engineers, a member of the American Gas Institute the Guild of Gas Managers of N. E., and the "Gas Meeters." He contributes an article in this issue.

AT the annual meeting of the Municipal Gas Company, Albany, N. Y., the following officers were re-elected: President, Nicholas F. Brady; Vice-President, Carl H. Graf; Secretary-Treasurer, William G. Furlong.

Financial Notes.

INVESTORS interested in the securities of the MASSACHUSETTS LIGHTING COMPANIES will find a valuable article, covering the property, in the Boston (Mass.) "Globe," under the date of May 4th, 1916. Some of the data included is as follows: "The company owns all but a few shares of the Adams Gas Light, Arlington Gas Light, Ayer Electric Light, Clinton Gas Light, Gas and Electric Improvement, Gloucester Gas Light, Harvard Gas & Electric, Leomister Electric Light & Power, Leominster Gas Light, Lexington Gas, Milford Electric Light and Power, Milford Gas Light, Mill River Electric Light, North Adams Gas Light, Northampton Electric Lighting, Northampton Gas Light, Spencer Gas Light, Heat and Power, Williamstown Gas and Worcester County Gas Companies—a total of 20 separate concerns. The following table gives the gross earnings of the subsidiaries over a period of years, the net earnings after operating expenses and taxes, the interest charges, and the balance available for dividends to the holding company:

Year.	Gross	Net.	Int. Chgs	Balance.
1915.....	$1,432,016	482,357	135,411	346 945
1914.....	1,472,868	473,401	130,259	343,142
1913.....	1,366,507	490,587	126,079	364,508
1912.....	1,213,366	399,178	115,138	284,034
*1911.....	1,218,742	416,343	111,865	304,478
1910.....	1,166,608	407,575	96.177	311,398
1909.....	840,646	300,537	74,100	226,428
1908.....	751,751	257,189	85,546	171,583

*Statements for the year ending Dec. 31 were issued prior June 30, 1912.

The officers of the company are: Arthur E. Childs, president; George F. Howland, treasurer; C. N. Burnell, auditor. Quite recently Mr. Howland succeeded Addis M. Whitney, who had been treasurer of the organization since incorporation. The trustees are: William M. Butler, Arthur E. Childs, Alfred Clarke, Chauncy D. Parker, Percy Parker, Bowen Tufts and Addis M. Whitney.

IF present plans are carried out the LINCOLN (Neb.) GAS & ELECTRIC LIGHT COMPANY will become, on June 20, a part of the Cities Service Company.

A call has been issued for a meeting of the stockholders of the Cities Service Company for the purpose of increasing the preferred stock to $60,000,000 and the common stock to $40,000,000.

At the same time the stockholders will vote on whether to buy the Montgomery (Ala.) Light Company and the Toledo (Ohio) Traction Company. The plan calls for the payment of 2% on the common on September 1, 4% on December 1, and 3% stock dividends each year in additiou to the 6% usual dividends.

The Lincoln Gas Company was organized in 1872, and was owned and managed by the H. J. Walsh interests, In 1890 C. W. Mosher got control of it, and the company embarked in the electric lighting business and absorbed all the new capital it could get. Later D. E. Thompson secured control, and placed it upon firm financial foundations. He sold the company to Wood & Havemeyer, New York brokers, who tried the game of high finance with it, but were unable to put it across, and Emerson McMillan took it over in order to protect old customers of his who had been induced to invest. In 1905 Mr. H. L. Doherty obtained control, and has been hard at work developing it ever since, at the same time fighting the dollar gas ordinance, as he wanted time to get the company on its feet. Several times he offered dollar gas if the consumers would not insist on the collection of back overcharges, and dollar gas is now in force. The acquisition of the company by the Cities Service Company will give stronger financial backing to the bond put up to pay these refunds if the city eventually wins.

Before the State Railway Commission recently, the company showed very satisfactory earnings, $191,000 net for the year based on a ten months' earnings. The company had a bonded indebtedness of $1,500,000, half of which had been issued, and application was made for the purpose of enabling it to retire some $500,000 of notes secured by bond collateral, to provide $150,000 for improvements and to otherwise fix its financial condition. The fact that the 5% 1941 notes were to be sold at 86 or better was taken to indicate its greatly improved status in the New York market.

THE SAN DIEGO CONSOLIDATED GAS AND ELECTRIC COMPANY has asked the California Railroad Commission for authority to buy the outstanding capital stock of the Oceanside Electric and Gas Company, and to take over all the latter company's property and incorporate it in its own plant. The applicant says the merger will permit it to extend its service and finance needed extensions and improvements.

PACIFIC GAS AND ELECTRIC, April gross decreased $25,575; net decreased $53,712; surplus decreased $35,327.

THE CONSOLIDATED GAS, ELECTRIC LIGHT AND POWER COMPANY, Baltimore, Md., reports April gross revenues of $622,430, an increase of $82,661. The net revenue was $296,884, an increase of $59,785.

A. J. EARLING, President of the Chicago, Milwaukee & St. Paul Railway, has become associated with Charles G. Dawes and E. G. Cowdery of Chicago and C. H. Dickey of Baltimore, in the organization and financing of SOUTHERN COUNTIES GAS COMPANY, which will take over a number of gas properties in Southern California. These men will take over $2,500,000 of the bonds of the consolidated company and also approximately $1,500,000 of its common stock, the latter at a price not far from par. That Mr. Earling is taking a large financial interest in a public utility corporation is causing some comment among men interested in securities. F. R. Bain, who has been president of Southern Counties Gas Company, will be in executive charge of the consolidated companies.

Current Prices of Public Utility Securities.

	Bid.	Asked.
American Gas Co	120	122
*American Gas & Electric	147	150
*American Gas & Electric pf	52	52
American Light & Traction	388	392
American Light & Traction pf	110½	112½
American Power & Light	67	72
American Power & Light pf	85	86½
American Public Utilities	45	47
American Public Utilities pf	76	79
Associated Gas & Electric pf	55	65
Atlantic P. & L. pf	92	95
Brooklyn Union Gas Co	127	130
Cities Service	282	284
Cities Service pf	87	88
Colorada Power	25	26
Colorado Power pf	99½	101
*Commonwealth Pr., Ry. & Lt	64½	65
*Commonwealth Pr., Ry. & Lt. pf	84½	86
Consolidated Gas Co	138	139
Denver Gas & Electric gen. 5s	97	99
Electric Bond Deposit pf	85	86
Electric Bond & Share pf	99	100
Federal Light & Traction	11	13
Federal Light & Traction pf	45	49
Gas & Electric Securities	220	230
Gas & Electric Securities pf	90	95
Laclede Gas	106½	107
Northern States Power	77	78
Northern States Power pf	96	97½
Pacific Gas & Electric	56	58
Pacific Gas & Electric, original	89	91
Pacific Gas & Electric 1st pf	89	90
Public Service	130	131
Republic Ry. & Light Co	33	35
Republic Ry. & Light Co. pf	76	79
Southern California Edison	88	90
Southern California Edison pf	104½	106
*Standard Gas & Electric	13½	14
*Standard Gas & Electric pf	36½	37
Tennessee Ry., Light & Power	11½	12½
Tennessee Ry., Light & Power pf	52	53
Toledo Trac., Light & Power	45	45
Toledo Trac., Light & Power pf	80	85
*United Gas Improvement Co	88	89
United Light & Railways	52	54
United Light & Railways 1st pf	76½	78
Western Power	17	18
Western Power pf	64¼	65

*Par value $50